Guidance for Developing
Watershed Management Plans in New Hampshire
for
Section 319 Nonpoint Source Grant Program Project

August 22, 2008
Revised: June 17, 2009
Revised October 5, 2009

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1. Background

Preserving, improving, and restoring the physical and biological integrity of our nation's waters are goals of the Clean Water Act, expressed through the implementation of programs by the New Hampshire Department of Environmental Services. To deal with all potential sources of water quality problems, it is often useful to prepare a Watershed Management Plan. Such a plan can link actions within the watershed to a water quality framework established in state water quality standards.

The NH Surface Water Quality Regulations establish water quality standards for the state's surface water uses as set forth in RSA 485-A:8. The standards are intended to protect public health and welfare, enhance the quality of water, and serve the purposes of the Clean Water Act and RSA 485-A. The standards provide for the protection and propagation of fish, shellfish, and wildlife, and provide for such uses as recreation activities in and on the surface of waters, public water supplies, agricultural and industrial uses, and navigation in accord with RSA 485-A:8. In addition, the standards provide an antidegradation provision which requires that the water quality necessary to protect existing uses of the state's surface waters be maintained and protected. To that end, a watershed management plan is used as a decision-making tool to establish water quality goals and determine what actions are needed to meet those goals and the water quality standards.

2. Purpose of this Guidance

This document applies to organizations, or subcontractors, to develop key components of a watershed management plan being funded under Section 319 Watershed Assistance Grants funds, or any effort that seeks a quantitative framework for watershed management in the state of New Hampshire.

This guidance applies to high quality, threatened, and impaired waters. The purpose of this guidance is to assist in the development of a comprehensive, quantitative Watershed Management Plan. This guidance provides a step-by-step approach to:

1. Develop waterbody specific water quality goals for various water quality parameters,
2. Calculate existing water quality and the associated assimilative capacity (or negative assimilative capacity in the case of impaired waters),
3. Determine actions that are needed to achieve the established goals.

3. About Watershed Management Plans

A watershed management plan is a tool for managing existing and future watershed conditions, including land use planning and potential impacts on surface water quality. Plans identify existing pollution contributions and sources, help establish water quality goals, estimate the reductions or limits of pollutants needed to meet water quality goals, and identify the actions

needed to achieve pollutant reductions. Watershed management plans prioritize recommended actions based on cost/benefit analysis, and set an implementation timeline. They also describe potential sources of funding that may be available to carry out components of the plan.

Watershed management plans are used by municipal governments, conservation districts, local watershed groups, and other interested stakeholders, to plan for future land use and develop zoning ordinances in a way that is protective of water quality. Other users may include local project managers, local landowners and government agencies, NHDES Watershed Management Bureau, and the US EPA.

Additional potential uses of the watershed management plan are:

- Documenting existing water quality characteristics to serve as a baseline for future comparison;
- Predicting water quality responses to land use changes and development activities over time;
- Quantifying environmental impact from land uses changes, land development, or similar activities;
- Establishing a monitoring program to determine trends in water quality over time;
- Assessing watershed response to management activities;
- Establishing watershed restoration design and monitoring activities;
- Design of best management practices;
- Development of land use regulations;
- Regulatory permitting decisions; and,
- Building local capacity for watershed protection and management.

The NHDES elements of watershed management planning projects have been designed to address both the federal and state Antidegradation Provisions[1] as well as EPA's key elements for watershed management planning (in Attachment D).

This is accomplished through the implementation of the scopes of work outlined in the approved grant agreements for projects awarded under the NHDES Section 319 Grant Program. The project tasks in Section 4, below, provide an example of a scope of work for development of a watershed management plan for phosphorus in a lake. Individual projects may target different pollutants and different waterbodies, however the basic framework outlined in the example below should be the same for each project.

[1] The NH Antidegradation Provisions (Env-Ws 1708) protect and maintain the water quality of state surface waters by establishing limits on the type and amount of pollutants that a waterbody can receive. The New Hampshire Antidegradation Provision is part of the NH Surface Water Quality Standards, as required under the federal antidegradation regulation 40CFR 131.12.

4. Project Tasks

Tasks 1-8 below provide an example of a scope of work for development of a watershed management plan for phosphorus in a lake. Tasks specific to individual projects would be detailed in a similar way in the project grant agreement and should be followed to develop a watershed management plan that meets the requirements of NHDES and EPA's key elements a-i:

1. Develop a Site Specific Project Plan (SSPP)
   The SSPP should document the following, using the template provided in Attachment A:
   - The type and source(s) of the data being used to determine existing water quality (see Section 5).
   - The process used to verify that the quality of the data is acceptable for use in determining existing water quality.
   - The process used to determine the water quality goals.
   - A description of the model used to:
     - Estimate the current and future pollution sources and loadings.
     - Estimate the pollutant reductions needed to meet the water quality goals.

     At a minimum the description should include: the name, date, revision number, and name of the organization or individual who developed the model/method.
   - Identification of the person(s) responsible for running the loading models and their qualifications.

   TASK DELIVERABLE: Completed Site Specific Project Plan documenting bulleted items above.

2. Collect and Verify Existing Water Quality Data (EPA key elements a & b)
   Historical data is used to determine the existing water quality of a given waterbody. Coordination with state, federal, or local organizations, or the public, for the purposes of initial data gathering, historical accounts, and other pertinent information may be necessary. The quality of the data used to determine existing water quality must be verified according to the process documented in the SSPP. See Section 5 for a description of the data sources that NHDES considers "acceptable" to be used in determining existing water quality.

   Once the quality of the data has been verified, it is used to calculate the current median water quality for the parameter(s) of concern. Calculation of current median water quality should be conducted in accordance with the *Standard Operating Procedure for Assimilative Capacity Analysis for New Hampshire Waters* located in Attachment B.

   TASK DELIVERABLE: Documentation of data quality assessment process and calculation of the current existing water quality for the parameters of concern.

3. Conduct Assimilative Capacity Analysis (EPA key element b)
   An analysis of a waterbody's assimilative capacity is used to determine the total assimilative capacity, the reserve assimilative capacity, and the remaining assimilative capacity (high quality and threatened waters) or negative assimilative capacity (impaired

waters) of each water quality parameter being considered. This information is then used to determine water quality goals and actions necessary to achieve those goals.

The assimilative capacity analysis should be conducted in accordance with the *Standard Operating Procedure for Assimilative Capacity Analysis for New Hampshire Waters* located in Attachment B. The Assimilative Capacity Calculation Worksheet, a simple Microsoft Excel spreadsheet (available upon request from NHDES), can be used to complete the analysis.

TASK DELIVERABLE: Documentation of assimilative capacity analysis including total assimilative capacity, remaining assimilative capacity or negative assimilative capacity, reserve assimilative capacity.

4. Establish Water Quality Goal(s) (EPA key element h)

After the assimilative capacity analysis is conducted, the water quality goal is established for the parameter(s) of concern. At a minimum, the water quality goal must be greater than the reserve assimilative capacity. To complete this task, it is recommended that a water quality advisory committee be assembled. *Note that for Section 319-funded projects, an advisory committee must be assembled*. The advisory committee should be comprised of local stakeholders and project partners, including NHDES. The committee will develop a process to be used to determine the water quality goal (to be documented in the SSPP). They will then carry out the process for determining the water quality goal, and make a recommendation for a formal goal. Once agreed upon, the water quality goal will be formally established and used to guide the development of the watershed management plan.

TASK DELIVERABLE: Formal establishment of the water quality goal(s) for each parameter of concern and documentation of the process used to formally arrive at the water quality goal(s).

5. Identify Current and Potential Future Pollution Sources (EPA key element a)

Identification of current and potential future pollution sources should be completed through the use of a pollutant loading analysis model, such as the Spreadsheet Tool for Estimating Pollutant Loads (STEPL), which determines the annual pollution source loads for each subwatershed. The model outputs may be refined based upon site specific knowledge.

NHDES and EPA recognize that, due to variability in site and weather characteristics (among other factors), loading estimations are extremely difficult to derive accurately. Accordingly, loading estimations for New Hampshire Section 319 Watershed Assistance Grants projects are developed using simple models or equations and are calculated by the grantee. NHDES recommends that grantees use the STEPL model, when applicable; however, there are many other models available. Information on the model input requirements, calibrating, and running the STEPL model are described in the user manual available at: http://it.tetratech-ffx.com/stepl/models$docs.htm. If a grantee elects to use

an alternative model, either because STEPL does not model the parameter of concern or for other reasons, the grantee must provide the rationale for its use to NHDES and show that, at a minimum, the selected model produces output information equivalent to STEPL (documented in the SSPP). Information on additional models available for use is included in Attachment C.

TASK DELIVERABLE: Documented identification of the current and future pollution source loads by land use type and source group by subwatershed for each parameter.

6. Estimate Pollution Limits or Reductions Needed (EPA key element b)
After the pollution sources have been identified, the total load limits or reductions needed to maintain the water quality goals for future watershed conditions are estimated through modeling. High quality waters may need to limit future pollutant loading to meet their desired water quality goal. Impaired waters will need to reduce existing loading to meet water quality criteria and restore the use. For example, for phosphorus, the Dillon-Rigler and Vollenweider models are used to estimate the in-lake phosphorus concentration based on existing and future phosphorus loading from the watershed. The model outputs are analyzed to determine the phosphorus reductions or limitations needed to achieve the in-lake phosphorus water quality goal.

Grant recipients or subcontractors select the models to be used depending on the parameter(s) of concern, the input requirements, and a variety of other factors. The grant recipient or subcontractor must provide the rationale for model selection to NHDES (documented in the SSPP).

TASK DELIVERABLE: A documented estimate of the total load limits or reduction needed to achieve the water quality goal for future watershed conditions.

7. Develop Watershed Management Plan (EPA key elements c, d, f, g, h & i)
Development of the watershed management plan consists of two primary components.

Determine Actions to Limit or Reduce Pollution
Determining the actions or management measures that should be implemented to meet the established water quality goal(s) is accomplished by estimating the pollutant removal efficiency expected for each management measures (e.g., implementation of best management practices (BMPs)) and determining which measure, or combination of measures, are needed to achieve the necessary load limits or reductions estimated under Task 6. Available pollutant removal efficiency values of various BMPs can be obtained from NHDES upon request.

This process also takes into consideration estimates of the amount of technical and financial assistance that is needed, the associated costs, and the sources and authorities that will be relied upon to implement the management measures, as well as a schedule for implementation.

Develop Plan Verification System

To verify that the recommended control actions are being implemented, interim, measurable milestones are identified and success indicators are established to determine whether loading reductions are being achieved and progress is being made toward attaining the water quality goals.

A system of verification is developed and documented that is to be used once the watershed management plan is implemented. The intention of the verification system is to determine if the management measures identified in the watershed management plan are working toward achieving the water quality goals. The verification system consists of the following:

1. Interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented.
2. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established (bullet below).
3. A set of criteria that can be used to determine whether the desired pollutant loading is being achieved over time and if substantial progress is being made towards attaining water quality standards, and, if not, the criteria for determining whether this watershed-based plan needs to be revised.

TASK DELIVERABLE: Documented description of the actions/management measures needed to achieve the necessary load reduction estimates under Task 6. A documented method to measure the effectiveness of the actions/management measures that will achieve the necessary load reductions.

8. Outreach and Education (EPA key element e)

The outreach and education component of watershed management planning is twofold. The first part is project-specific and is developed to enhance the public's understanding of the watershed management plan development. Outreach should focus on the purpose of watershed planning, key issues in the selected watershed, and should encourage public participation in selecting, designing, and implementing the actions/management measures for the plan.

The second part is plan-specific and is a separate chapter or section contained within the watershed management plan document. For this, it is recommended that an outreach and education advisory committee be assembled to develop recommendations for public outreach and education activities to be performed during plan implementation.

TASK DELIVERABLES: Project-specific outreach and education plan. Plan-specific outreach and education plan.

5. Quality Objectives and Criteria

This section describes the quality objectives for conducting the assimilative capacity analysis, pollutant loading estimation, and selection of best management practices (BMPs) associated with watershed management planning activities.

Assimilative Capacity Analysis:

Secondary Data

The quality of the secondary data being used to determine the existing water quality (i.e., the current median water quality) and to conduct assimilative capacity analysis is extremely important because the water quality goals and plan action items are based upon it. The following data sources are considered to have inherent acceptable accuracy and precision standards and are acceptable for the purposes of watershed management planning, including but not limited to:

- USGS Stream Gage Data
- FEMA Flood Insurance Study data
- USGS or USDA aerial photo coverages
- NHDES data contained in the NHDES Environmental Monitoring Database (EMD) that is flagged as final data and has been through QA/QC procedures.
- Volunteer or other monitoring data contained in the NHDES EMD that is flagged as final data and has been through QA/QC procedures.
- NH Fish and Game data

If other data are used, a rationale for their use must be provided to NHDES in the SSPP (Task 1) including: the type(s) of data to be used (historical, precipitation data, soil maps, site maps, literature files, databases, etc.), the source of the data, the intended use of the data, a description of how the data was determined to be of acceptable quality for this intended use, the quality control that was performed when the original data was collected, and any limitation to the data that should be considered in understanding the calculations.

Assimilative Capacity Calculations

Quality objectives and criteria for assimilative capacity analyses are described the *Standard Operating Procedures for Assimilative Capacity Analysis for New Hampshire Waters* located in Attachment B. Any deviations from the SOP will be documented and provided to NHDES.

Pollutant Loading Estimation:

The data used for this project is for the sole purpose of estimating pre- and post-implementation pollutant loads using simple models and equations such as the Spreadsheet Tool for Estimating Pollutant Loads (STEPL), and in-situ water quality data for parameters of concern using models such as Dillon-Rigler and Vollenweider Trophic Status Models. The type and quantity of data required are specified in the methods or the models' user manuals.

When running the models/methods, a second person verifies the input values to prevent transcription errors. In addition, a duplicate run, conducted by a second modeler, is done each time the model is used. This will further reduce transcription errors and ensure proper estimates. If transcription or model errors are identified, the grantee project manager or person identified in the SSPP is responsible for correcting the error or, if unable to correct the error, consults with the NHDES Project Manager or a representative from the organization that created the model.

Grantees are responsible for providing the rationale for model selection and supporting documents to NHDES in the SSPP.

Action/Management Measure Selection
The grantee will document the process and criteria used to select actions and management measures (see Task 7) that are recommended in the watershed management plan. The description of the process and the criteria used should be included in the watershed management plan. The selection process should take into consideration the pollutants of concern, the proposed site conditions, cost of implementation, potential alternatives, operation and maintenance.

The grantee will document and provide to NHDES any QA/QC activities for the selection of watershed management plan actions and management measures to be recommended in the plan as described in Task 7.

6. Special Training/Certification

Project personnel conducting the loading analysis will be trained in the applicable model or method.

The designated grantee project manager is responsible for assuring that all necessary staff are trained in the loading analyses including operation and appropriate use of the selected loading model(s) and understanding the appropriate need for accuracy and quality control in running the model(s). Project staff are required to be familiar with this guidance and the SSPP. Project staff must demonstrate proficiency in running the loading model.

Training records must be kept by the grantee to document the type of training, training attendees, training provider, and the date the training was completed, if applicable. Training records are made available to NHDES upon request.

7. Documentation and Records

All documents created as part of watershed management planning projects including, but not limited to electronic and hard copies of management plan drafts, secondary data, model input data, model outputs, or print outs of on-going work will be maintained and stored in accordance with the *New Hampshire 319 Nonpoint Source Program Quality Assurance Program Plan* (QAPgP)

References

Currier, Paul. *Antidegradation Review Guidance on Estimating Assimilative Capacity, 10% Reserve Assimilative Capacity, High Quality Waters and Remaining Assimilative Capacity.* Water Quality Standards Advisory Committee Discussion Paper. April 6, 2006.

ENSR. *Total Maximum Daily Load Study for Harvey Lake, Northwood, NH.* DRAFT January 2008.

New Hampshire Code of Administrative Rules. Chapter Env-Ws 1700 Surface Water Quality Regulations.

New Hampshire Department of Environmental Services. *2006 Section 305(b) and 303(d) Consolidated Assessment and Listing Methodology.* NHDES-R-WD-05-29. November 2005.

New Hampshire Department of Environmental Services. *Antidegradation of NH Waters Draft Fact Sheet*. WD-WMB-23. December 2007.

Trowbridge, Phil. State of NH Inter-Department Communication. *Analysis of NHDES Data to Determine Preliminary Total Phosphorus Criteria for Freshwaters.* August 5, 2005.

United States Environmental Protection Agency. Office of Water. Nonpoint Source Control Branch. *Handbook for Developing Watershed Plans to Restore and Protect our Waters*. EPA 841-B-08-002. March 2008.

Attachment A – Site Specific Project Plan (SSPP) Template

SITE SPECIFIC PROJECT PLAN FOR:

(Insert Project Title)
(Insert NHDES Project Number)

Under the New Hampshire Section 319 Nonpoint Source Grant Program QAPP
RFA# 08262

Final Draft
(Insert Date)

Prepared by:
(Name)
(Address)
(Contact Information)

Project Manager: _____
Signature/Date
(Insert Name)

Technical Project Manager/QA Officer: _____
Signature/Date
(Insert Name)

NHDES Project Manager: _____
Signature/Date
(Insert Name), NHDES

Program Quality Assurance Coordinator: _____
Signature/Date
Jillian E. McCarthy, NHDES

NHDES Quality Assurance Manager: _____
Signature/Date
Vincent Perelli, NHDES

Distribution List & Project Organization

Table 1 presents a list of people who will receive the approved SSPP, and any amendments.

Table 1. SSPP Distribution List

SSPP Recipient Name	Project Role	Organization	Telephone number and Email address
add names or delete			
Jillian McCarthy	Program QA Coordinator	NHDES Watershed Management Bureau	603-271-8475 jmccarthy@des.state.nh.us
Vincent Perelli	NHDES Quality Assurance Manager	NH DES Planning Unit	603-271-8989 vperelli@des.state.nh.us

Problem Definition/Background

Provide a brief description of the project, the problem being addressed and pertinent project background.

Historical Data Information

What type of data is going to be used?

What is the source(s) of the data?

What process will be used to determine that the quality of the data is acceptable for use in calculating the existing water quality? Please describe.

Establishing Water Quality Goals

What pollutants are water quality goals being established for?

What process will be used to determine the water quality goals? Please describe.

Loading Models

For each model, please include the name, date, revision number, name of the organization or individual who developed the model/method, and the person(s) responsible for running the model as well as reference the user manual or method for the model.

Which model will be used to estimate the current and future pollution sources and loadings?

Which model will be used to estimate in-situ pollutant concentrations and as a result, the pollutant reductions or limitations needed to meet the water quality goals?

Identifiy of the person(s) responsible for running the loading models and their qualifications.

Attachment B –Standard Operating Procedures for Assimilative Capacity Analysis for New Hampshire Waters

Watershed Assistance Section

Standard Operating Procedure (SOP)

Assimilative Capacity Analysis for
Watershed Management Planning Projects: Lakes
Section 319 Watershed Assistance Grants

August 22, 2008

Written by: Jillian McCarthy
Watershed Management Bureau
NH Dept. of Environmental Services

I. Background:

Assimilative capacity refers to the amount of a pollutant that can be safely released to a waterbody without causing violations of applicable water quality criteria or negatively impacting uses (Env-Wq 1702.03). It applies independently to each applicable water quality parameter and to each waterbody assessment unit. Assessment units (AU) were established by NHDES in 2002 as the basic unit of record for conducting and reporting water quality assessments.

Assimilative capacity analysis is conducted to determine if remaining assimilative capacity exists for a given water quality parameter in a specific waterbody. The total assimilative capacity is the difference between the best possible water quality and the water quality (WQ) standard. Remaining assimilative capacity is the difference between the existing water quality and the WQ standard plus (+) a 10% reserve. The antidegradation provisions of the NH Surface Water Quality Standards (Env-Ws 1705.01) require that, at a minimum, 10% of the total assimilative capacity of any waterbody must be held in reserve.

Once the remaining assimilative capacity is determined, the waterbody can be classified as either “impaired”, “Tier 1”, or “Tier 2” (high quality) for each parameter. An impaired water is one in which the water quality of one or more parameters is worse than the standard. Impaired waters have a negative assimilative capacity and require reductions in pollutant loading in order to restore the waterbody simply to meet the standard. A Tier 1 waterbody is one in which the water quality of one or more parameters is better than the standard, but within the 10% reserve assimilative capacity. A Tier 2 or high quality waterbody is one in

which the water quality of one or more parameters is better than the standard plus (+) 10% reserve. Therefore, Tier 2 waters have some assimilative capacity remaining, whereas impaired and Tier 1 waters do not. This means that water quality can be lowered in Tier 2 waters. However, under the federal antidegradation regulation 40CFR 131.12(a)(2), the water quality of high quality waters is required to be maintained and protected unless there are important economic or social reasons why lower water quality should be allowed. Figure 1. shows a conceptual diagram of assimilative capacity of phosphorus in lakes.

In NH, an "insignificant" lowering of water quality is allowed for Tier 2 waters. An activity is considered insignificant if it increases loading by less than 20% of the remaining assimilative capacity. A proposed activity that will use 20% or more of the remaining assimilative capacity is considered significant, and requires an economic and social analysis to justify the lowering of water quality (Env-Wq 1708.07).

II. Purpose:

The purpose of this SOP is to outline the process for conducting assimilative capacity analysis for watershed management planning projects under the Section 319 Watershed Assistance Grants Program. The assimilative capacity analysis serves to calculate the existing median water quality, total assimilative capacity, reserve assimilative capacity, and remaining assimilative capacity. This analysis is used to establish water quality goals for pollutants of concern for watershed management planning and to develop recommendations for implementation actions in watershed management planning documents.

III. NHDES Staff

Name	Title	Contact
Eric Williams	Watershed Assistance Supervisor	603-271-2358 eric.williams@des.nh.gov
Steve Landry	Merrimack Watershed Supervisor	603-271-2969 stephen.landry@des.nh.gov
Sally Soule	Coastal Watershed Supervisor	603-559-0032 sally.soule@des.nh.gov
Andrew Chapman	Clean Lakes Coordinator	603-271-5334 andrew.chapman@des.nh.gov
Jillian McCarthy	Nonpoint Source QA Officer	603-271-8475 jillian.mccarthy@des.nh.gov
Jeffrey Marcoux	Grant Administrator	603-271-8862 jeffrey.marcoux@des.nh.gov

IV. Determining Existing Median Water Quality for Lakes:

Existing median water quality is determined through the collection and analysis of historical water quality data for the waterbody being studied. The historical data is considered secondary data since it has been previously collected by another party for purposes other than this analysis. All data used for analysis of assimilative capacity should be contained in the NHDES Environmental Monitoring Database (EMD). If the data is not in the EMD, it should be submitted to NHDES for inclusion.

For NHDES to accept data it must have documented QA/QC procedures including, but not limited to:

- An approved quality assurance project plan (QAPP)
- Standard operating procedures (SOP) for data collection
- Other NHDES-approved QC document.

Querying the EMD

Example: Query for in-lake phosphorus data

1. Access the EMD through the NHDES OneStop website at: http://www2.des.state.nh.us/OneStop/Environmental_Monitoring_Menu.aspx.
2. Select "Grab Samples" or "Time Series Results From Automated Data Loggers" and click "Go". (You should query both sample types to ensure all data is included in analysis).
3. Enter a valid email address (in order to retrieve query results, a valid email address must be given. When the query is completed, an email from emd@des.nh.gov will be sent directing where to retrieve the results of the file. It may take several days to receive the query results depending on the amount of data).
4. Select "Excel" as the output type.
5. Under Station Type, select "LAKE/POND".
6. Under Water Body Name, select the targeted waterbody.
7. Under Parameter/Analyte Name, select "PHOSPHORUS AS P".
8. Click "Submit Query".
   The query will be assigned a job number. This number will be referenced in the email notification and the Excel output file. For assistance or questions on querying the EMD, please contact Andrew Cornwell at (603) 271-1152 or andrew.cornwell@des.nh.gov.

Retrieving the Query Data

1. You will receive an email from emd@des.nh.gov titled "Your Environmental Monitoring Database Query Results". Open this email and click on the link to the data.
2. A "WinZip" window will open with an Excel output file. Double click the file to open it.
3. The Excel output file has three worksheets. Each worksheet references the job number:
   - "**Project_Data_Job_####**" – background data including organization, project manager, sampling station information, waterbody information, etc.
   - "**Results_Job_####_Sheet_1**" – actual water quality data
   - "**Query_Parameters_Job_####**" – summarizes the query parameters

Calculating Existing Median Water Quality

1. Create a new worksheet in the Excel output file and name it "Median Calculation".
2. In the **Project_Data_Job_####** worksheet, highlight columns
   AC – "DEPTH ZONE" and
   AF – "START DATE"
   Copy and paste these columns into the new worksheet columns A and B.
3. In the **Results_Job_####_Sheet_1** worksheet, highlight columns
   C – "ACTIVITY_ID",

D – "PHOSPHORUS AS P RESULT",
E – "PHOSPHORUS AS P QUALIFIER", and
F – "PHOSPHORUS AS P UNITS".
Copy and paste these columns into the new worksheet columns C through F.

4. Filter the data to show only **EPILIMNION** data in the **DEPTH ZONE** column.
5. For any data points where the qualifier indicates that the data is "<" 0.005 mg/L, use the value 0.0025 mg/L.
6. In a separate cell use the MEDIAN function to determine the median value of the data using the following steps.
    a. Type "=MEDIAN(" with an open parenthesis "(".
    b. Highlight the column of water quality data using the mouse.
    c. Type a closed parenthesis ")" and hit enter. The median value will be displayed in the cell.

V. Calculations for Determining the Assimilative Capacity

The Assimilative Capacity Analysis Spreadsheet, available from NHDES upon request, can be used to calculate the total assimilative capacity, reserve assimilative capacity, and the remaining assimilative capacity. The spreadsheet uses the following simple equations:

Total Assimilative Capacity

The total assimilative capacity is the difference between the WQ standard and the best possible water quality. The total assimilative capacity is determined using the following equation:

Total Assimilative Capacity = WQ Standard – Best Possible Water Quality

Where, for the parameter phosphorus,
Phosphorus WQ Standard[*] = 10 µg/L
Best Possible Phosphorus Water Quality = 0 µg/L

Reserve Assimilative Capacity

The antidegradation provisions of the NH Surface Water Quality Standards (Env-Wq 1708) require that 10% of the assimilative capacity of any waterbody must be held in reserve. The reserve assimilative capacity is determined using the following equation.

*Reserve Assimilative Capacity = (0.10) * (Total Assimilative Capacity)*

Where, for the parameter phosphorus,
Phosphorus WQ Standard[*] = 10 µg/L

[*] 10 µg/L is a preliminary value based on the *Draft 2008 Chlorophyll-a and Phosphorus in New Hampshire Lakes for Nutrient Criteria Development*, prepared by Philip Trowbridge, NHDES, June 20, 2008. The narrative phosphorus water quality standard is located in the NH Code of Administrative Rules Chapter Env-Wq 1700 Surface Water Quality Regulations.

Remaining Assimilative Capacity

The remaining assimilative capacity is the difference between the reserve assimilative capacity and the existing median water quality. It is determined using the following equation.

Remaining Assimilative Capacity =
(WQ Standard – Reserve Assimilative Capacity) – (Existing Median WQ)

Where, for the parameter phosphorus,
Phosphorus WQ Standard[*] = 10 µg/L

Calculating Assimilative Capacity using the NHDES Spreadsheet

Assimilative capacity can be calculated using the equations above or by following the steps below in the Assimilative Capacity Analysis spreadsheet:

1. Using the Assimilative Capacity Analysis spreadsheet, select the Input Worksheet and enter the existing median water quality value in the red-highlighted cell:

Existing Median Water Quality	enter value	µg/L

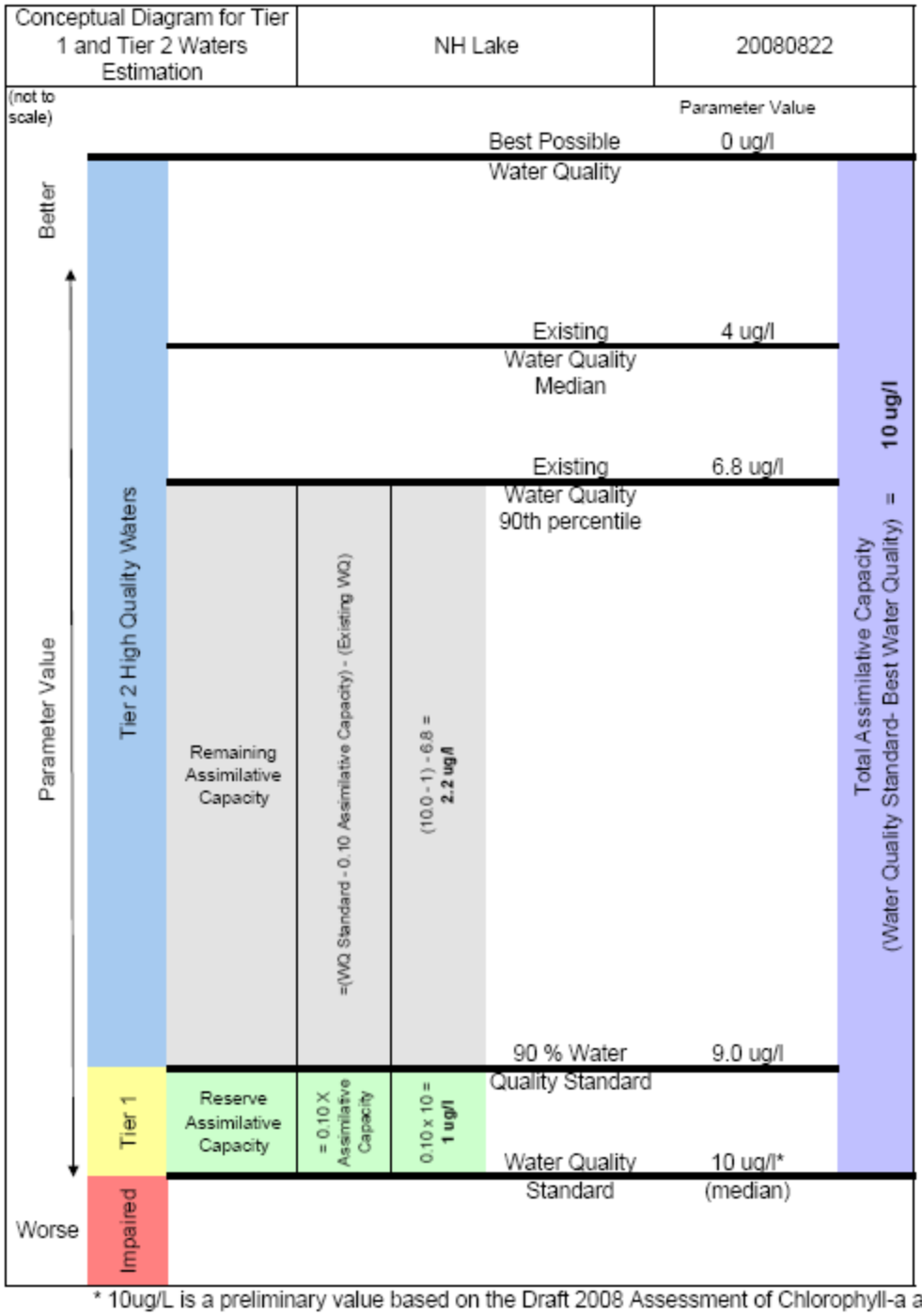
2. The Output Worksheet will display the values for total assimilative capacity, reserve assimilative capacity, and remaining assimilative capacity.

VI. Quality Control Procedures

A duplicate analysis is conducted for calculating existing median water quality and for calculating the assimilative capacity.

VII. Record Retention and Archive Procedures

All assimilative capacity analysis documents are stored electronically by the 319 grantee and NHDES. Electronic copies developed by or submitted to NHDES are stored on the Watershed Management Bureau's network drive (H drive). Grant-recipients should retain copies of the analysis documents in their grant project files. NHDES and the grant-recipient are to retain the assimilative capacity analysis documents, and all other project documents, for a minimum of three (3) years after the project has been completed. After three years, all files can be purged. Electronic files of the completed watershed management plans are stored indefinitely on the Watershed Management Bureau's network drive (H drive).



* 10ug/L is a preliminary value based on the Draft 2008 Assessment of Chlorophyll-a and Phosphorus in New Hampshire Lakes for Nutrient Criteria Development, prepared by Philip Trowbridge, NH DES, June 20, 2008.

Figure 1 Assimilative Capacity Conceptual Diagram example, phosphorus in lakes.

References

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Attachment C – Information on Available Models

The following watershed models are publicly available for estimating loads, providing source load estimates, and evaluating various management alternatives. The models vary in complexity, the amount of input data required, the parameters that are modeled and many other factors. Careful consideration should be given to model selection.

The tables below are taken from the EPA document, *Handbook for Developing Watershed Plans to Restore and Protect our Waters*, and give an overview of several available watershed models. Additional information on the application of these models is further explained in the EPA document or at the following:

AGNPS
www.ars.usda.gov/research/docs.htm?docid=5199

STEPL
Temporary URL http://it.tetratech-ffx.com/stepl

GWLF
The original version of the model has been used for 15 years and can be obtained from Dr. Douglas Haith at Cornell University. A Windows interface (Dai et al. 2000) is available at www.vims.edu/ bio/vimsida/basinsim.html. Penn State University developed an ArcView interface for GWLF (www.avgwlf.psu.edu) and compiled data for the entire state of Pennsylvania (Evans et al. 2002).

HSPF
HSPF is available through EPA's Center for Exposure Assessment Modeling (www.epa.gov/ceampubl/swater/hspf) and also as part of EPA's BASINS system (www.epa.gov/ost/basins/). Another formulation of HSPF is EPA's Loading Simulation Program in C++ (LSPC), which can be downloaded at www.epa.gov/athens/wwqtsc/html/lspc.html.

P8-UCM
www.wwwalker.net/p8/p8v24.zip

SWAT
www.brc.tamus.edu/swat SWAT is also included in EPA's BASINS system www.epa.gov/waterscience/basins/basinsv3.htm.

SWMM
www.epa.gov/ednnrmrl/models/swmm/index.htm

Table C-1. Overview of Several Available Watershed Models.

		Type		Level of Complexity			Time step				Hydro-logy		Water Quality					Type of BMPs						
Model Acronym	Source	Landscape only	Comprehensive	Export coefficients	Loading functions	Physically based	Sub-daily	Daily	Monthly	Annual	Surface	Surface and ground water	User-defined	Sediment	Nutrients	Toxic/pesticides	Metals	BOD	Bacteria	Detention basin	Infiltration practices	Vegetative practices	Wetlands	Other structures
AGNPS (event-based)	USDA-ARS	●	●	—	—	●	●	—	—	—	●	—	—	●	●	●	—	—	—	●	—	●	—	—
AnnAGNPS	USDA-ARS	—	●	—	—	●	—	●	—	—	●	—	—	●	●	●	—	—	—	●	—	●	—	—
BASINS	EPA	—	●	●	●	●	●	●	—	—	●	●	●	●	●	●	●	●	●	●	—	●	—	●
DIAS/IIDLMAS	Argonne National Laboratory	—	—	—	—	—	—	—	—	●	—	—	—	●	—	—	—	—	—	—	—	—	—	—	—
DRAINMOD	North Carolina State University	—	—	—	—	●	●	—	—	—	—	●	—	—	●	—	—	—	—	—	—	—	●	—
DWSM (event-based)	Illinois State Water Survey	—	●	—	—	●	●	—	—	—	●	—	—	●	●	●	—	—	—	●	●	—	—	—
EPIC	Texas A&M University–Texas Agricultural Experiment Station	—	—	—	—	—	—	●	—	—	●	—	—	●	●	●	—	—	—	●	●	—	●	—
GISPLM	College of Charleston, Stone Environmental, and Dr. William Walker	—	●	—	●	—	—	●	—	—	●	—	—	—	●	—	—	—	—	—	—	—	—	—	—
GLEAMS	USDA-ARS	—	—	—	—	—	—	●	—	—	●	—	—	●	●	●	—	—	—	—	—	—	—	—	—
GSSHA	USACE	●	●	—	—	●	●	—	—	—	—	●	—	●	—	—	—	—	—	●	●		●	●
GWLF	Cornell University	—	●	—	●	—	—	—	●	—	—	●	—	●	●	—	—	—	—	—	—	●	—	—
HEC-HMS	USACE	—	●	—	—	●	●	—	—	—	●	—	—	—	—	—	—	—	—	—	—	—	—	—
HSPF	EPA	—	●	—	—	●	●	—	—	—	—	●	●	●	●	●	●	●	●	—	—	—	—	—
KINEROS2 (event-based)	USDA-ARS	—	●	—	—	●	●	—	—	—	●	—	—	●	—	—	—	—	—	●	—	●	—	●
LSPC	EPA and Tetra Tech, Inc.	—	●	—	—	●	●	—	—	—	—	●	●	●	●	●	●	●	●	●	—	●	—	●
Mercury Loading Mode	EPA	—	—	—	—	●	—	—	—	●	●	—	—	—	—	—	●	—	—	—	—	—	—	—
MIKE SHE	Danish Hydraulic Institute	—	●	—	—	●	●	—	—	—	—	●	—	—	—	—	—	—	—	—	—	—	—	—
MINTEQA2	EPA	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	●	—	—	—	—	—	—	—
MUSIC	Monash University, Cooperative Research Center for Catchment Hydrology	—	—	—	—	●	●	—	—	—	●	—	●	—	—	—	—	—	—	●	●	●	●	●

Table C-1 (cont.) Overview of Several Available Watershed Models.

		Type		Level of Complexity			Time step				Hydro-logy		Water Quality					Type of BMPs						
Model Acronym	Source	Landscape only	Comprehensive	Export coefficients	Loading functions	Physically based	Sub-daily	Daily	Monthly	Annual	Surface	Surface and ground water	User-defined	Sediment	Nutrients	Toxic/pesticides	Metals	BOD	Bacteria	Detention basin	Infiltration practices	Vegetative practices	Wetlands	Other structures
P8-UCM	Dr. William Walker	—	—	●	●	—	●	—	—	—	●	—	●	●	●	—	●	—	—	●	●	●	—	●
PCSWMM	Computational Hydraulics Int.	—	●	—	●	●	●	—	—	—	—	●	●	●	●	●	●	—	●	●	●	—	—	●
PGC–BMP	Prince George's County, MD	—	—	—	●	—	●	—	—	—	—	—	—	●	●	—	●	—	—	●	●	●	●	●
REMM	USDA-ARS	—	—	—	—	—	—	—	—	—	—	—	—	●	●	●	●	—	—	—	—	●	—	—
SHETRAN	University of Newcastle (UK)	—	●	—	—	●	●	●	—	—	—	●	—	●	—	—	—	—	—	—	—	—	—	—
SLAMM	University of Alabama	—	—	—	—	—	●	—	—	—	●	—	—	●	●	—	●	—	—	●	●	●	●	●
SPARROW	USGS	—	●	—	—	—	—	—	—	●	●	—	—	●	●	●	—	—	—	—	—	—	—	—
STORM	USACE (mainframe version), Dodson & Associates, Inc. (PC version)	—	—	●	—	●	●	—	—	—	●	—	—	●	●	—	—	—	●	—	—	—	—	●
SWAT	USDA-ARS	—	●	—	—	●	—	●	—	—	—	●	—	●	●	●	●	—	—	●	●	●	—	●
SWMM	EPA	—	●	—	—	●	●	—	—	—	—	●	●	●	●	●	●	●	●	●	●	—	—	—
TMDL Toolbox	EPA	—	●	—	—	●	●	—	—	—	—	●	●	●	●	●	●	●	●	●	—	●	—	●
TOPMODEL	Lancaster University (UK), Institute of Environmental and Natural Sciences	—	—	—	—	●	●	●	—	—	—	●	—	—	—	—	—	—	—	—	—	—	—	—
WAMView	Soil and Water Engineering Technology, Inc. (SWET) and EPA	●	●	—	—	●	●	—	—	—	—	●	—	●	●	●	●	—	●	●	●	●	●	●
WARMF	Systech Engineering, Inc.	—	●	—	—	●	—	●	—	—	—	●	—	●	●	●	●	●	●	—	—	—	●	●
WEPP	USDA-ARS	—	—	—	—	●	—	●	●	●	—	●	—	●	—	—	—	—	—	—	●	—	—	—
WinHSPF	EPA	—	●	—	—	●	●	—	—	—	—	●	●	●	●	●	●	●	●	—	—	—	—	—
WMS	Environmental Modeling Systems, Inc.	—	●	—	—	●	●	—	—	—	—	●	●	●	●	●	●	●	●	●	●	—	●	●
XP-SWMM	XP Software, Inc.	—	●	—	—	●	●	—	—	—	—	●	●	●	●	●	●	●	●	●	●	—	—	●

Notes: BMPs = best management practices. — Not supported ● Supported

Source: USEPA. 2005. *TMDL Model Evaluation and Research Needs.* EPA/600/R-05/149. U.S. Environmental Protection Agency, Office of Research and Development, National Risk Management Research Laboratory, Cincinnati, OH. www.epa.gov/nrmrl/pubs/600r05149/600r05149.htm

Table C-2. Water Quality Endpoints Supported by the Selected Watershed Models.

Parameter/Endpoint	AGNPS	STEPL	GWLF[a]	HSPF	P8-UCM	SWAT	SWMM
Total phosphorus (TP) load	◗	○	◗	●	●	◗	●
TP concentration	◗	—	◗	●	●	◗	●
Total nitrogen (TN) load	◗	○	◗	●	●	◗	●
TN concentration	◗	—	◗	●	●	◗	●
Nitrate concentration	—	—	—	●	—	◗	●
Ammonia concentration	—	—	—	●	—	◗	●
TN:TP mass ratio	—	—	◗	●	—	◗	●
Dissolved oxygen	◗	—	—	●	—	◗	●
Chlorophyll *a*	—	—	—	●	—	◗	—
Algal density (mg/m²)	—	—	—	—	—	—	—
Net total suspended solids load	—	○	—	●	●	—	●
Total suspended solids concentration	◗	—	—	●	●	◗	●
Sediment concentration	◗	—	◗	●	●	◗	●
Sediment load	◗	○	◗	●	—	◗	●
Metals concentrations	—	—	—	●	—	◗	●
Conductivity	—	—	—	●	—	—	—
Pesticide concentrations	◗	—	—	●	—	◗	—
Herbicide concentrations	◗	—	—	●	—	◗	—
Toxics concentrations	—	—	—	●	—	—	—
Pathogen count (*E. coli*, fecal coliform bacteria)	—	—	—	●	—	◗	●
Temperature	—	—	—	●	—	◗	—

Key: — Not supported ○ Annual ◗ Daily ● Hourly

[a]GWLF calculations are performed on a daily basis, but the results are presented on a monthly basis.

Source: USEPA. 2005. *TMDL Model Evaluation and Research Needs*. EPA/600/R-05/149. U.S. Environmental Protection Agency, Office of Research and Development, National Risk Management Research Laboratory, Cincinnati, OH. www.epa.gov/nrmrl/pubs/600r05149/600r05149.htm

Table C-3. Land and Water features supported by the Selected Watershed Models.

Land and Water Feature	AGNPS	STEPL	GWLF	HSPF	P8-UCM	SWAT	SWMM
General Land and Water Features							
Urban	—	○	◗	◗	◗	◗	●
Rural	●	○	◗	●	○	●	◗
Agriculture	●	○	◗	●	○	●	○
Forest	—	○	◗	●	○	●	○
River	—	—	○	●	○	○	○
Lake	—	—	—	◗	—	○	○
Reservoir/impoundment	—	—	—	◗	◗	○	◗
Estuary (tidal)	—	—	—	—	—	—	—
Coastal (tidal/shoreline)	—	—	—	—	—	—	—
Detailed Land Features							
Air deposition	—	—	—	○	—	—	—
Wetlands	—	—	—	◗	○	○	○
Land-to-land simulation	○	—	—	○	—	—	—
Hydrologic modification	—	—	—	◗	—	—	◗
BMP siting/placement	●	—	—	○	◗	—	◗
Urban Land Management							
Street sweeping and vacuuming	—	—	○	—	◗	○	◗
Nutrient control practices (fertilizer, pet waste management)	◗	—	—	○	○	○	○
Stormwater structures (manhole, splitter)	—	—	—	—	○	—	◗
Detention/retention ponds	◗	—	—	○	◗	○	◗
Constructed wetland processes	—	—	—	—	○	○	○
Vegetative practices	◗	—	○	○	○	○	○
Infiltration practices	—	—	—	○	○	—	—
Rural Land Management							
Nutrient control practices (fertilizer, manure management)	●	○	○	●	—	●	○
Agricultural conservation practices (contouring, terracing, row cropping)	●	○	○	●	—	●	○
Irrigation practices/tile drains	○	—	—	—	—	●	—
Ponds	◗	—	—	◗	◗	◗	◗
Vegetative practices	◗	○	○	○	—	◗	—

Key: — Not supported
○ Low: Simplified representation of features, significant limitations
◗ Medium: Moderate level of analysis, some limitations
● High: Detailed simulation of processes associated with land or water feature

Source: USEPA. 2005. *TMDL Model Evaluation and Research Needs*. EPA/600/R-05/149. U.S. Environmental Protection Agency, Office of Research and Development, National Risk Management Research Laboratory, Cincinnati, OH. www.epa.gov/nrmrl/pubs/600r05149/600r05149.htm

Table C-4. Application Consideration of the Selected Watershed Models.

Application Considerations	AGNPS	STEPL	GWLF	HSPF	P8-UCM	SWAT	SWMM
Experience required	◗	●	●	—	●	○	—
Time needed for application	◗	●	●	—	●	◗	○
Data needs	◗	●	●	○	●	◗	○
Support available Support available	◗	○	○	●	○	◗	◗
Software tools	◗	●	●	●	○	●	○
Cost to purchase	●	●	●	●	●	●	●

Key:

Experience:

— Substantial training or modeling expertise required (generally requires professional experience with advanced watershed and/or hydrodynamic and water quality models)

○ Moderate training required (assuming some experience with basic watershed and/or water quality models)

◗ Limited training required (assuming some familiarity with basic environmental models)

● Little or no training required

Support Available:
— None
○ Low
◗ Medium
● High

Time Needed for Application:
— > 6 months
○ > 3 months
◗ > 1 month
● < 1 month

Software Tools:
— None
○ Low
◗ Medium
● High

Data Needs:
○ High
◗ Medium
● Low

Cost to Purchase:
— Significant cost (> $500)
○ Nominal cost (< $500)
◗ Limited distribution
● Public domain

Source: USEPA. 2005. *TMDL Model Evaluation and Research Needs*. EPA/600/R-05/149. U.S. Environmental Protection Agency, Office of Research and Development, National Risk Management Research Laboratory, Cincinnati, OH. *www.epa.gov/nrmrl/pubs/600r05149/600r05149.htm*

Attachment D – EPA Key Elements a-i for Watershed Management Plans

a) *Identify pollution causes and sources: An identification of the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in this watershed-based plan (and to achieve any other watershed goals identified in the watershed-based plan), as discussed in item (b) immediately below. Sources that need to be controlled should be identified at the significant subcategory level with estimates of the extent to which they are present in the watershed (e.g., X number of storm drains that need retrofits; Y miles of gravel roads that need drainage BMPs; or Z linear miles of eroded streambank needing remediation).*

b) *Estimate pollution reductions needed: An estimate of the load reductions expected for the management measures described under (c). Estimates should be provided at the same level as in item (a) above (e.g., the total load reduction expected for storm drain retrofits, gravel road BMPs or eroded streambanks). First quantify the pollutant loads for the watershed. Based on these pollutant loads, determine the reductions needed to meet water quality standards (or other goals).*

c) *Actions needed to reduce pollution: A description of the NPS management measures that will need to be implemented to achieve the load reduction or habitat restoration scope estimated under paragraph (b) above (as well as to achieve other watershed goals identified in this watershed-based plan), and an identification (using a map or a description) of the critical areas in which those measures will be needed to implement this plan*

d) *Costs and authority: An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon, to implement this plan. Describe the types and sources of match that will be used to implement the project, keeping in mind that at least 40% of the project cost must be provided in non-federal match.*

e) *Outreach and education: An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing NPS management measures.*

f) *Schedule: A schedule for implementing the NPS management measures identified in this plan that is reasonably expeditious.*

g) Milestones: A description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented.

h) Success indicators and evaluation: A set of criteria that can be used to determine whether loading reductions or habitat restoration is being achieved over time and substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether this watershed-based plan needs to be revised.

i) Monitoring plan: A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item (h) immediately above.